

A Spatial Relation Perspective on the City-Station Link: Cases Study on Florence S.M.N and Madrid Atocha



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Abstract Train stations as public spaces representing the city, have become gathering points for the city and its inhabitants, acting almost as “gateways to the city” in addition to serving as intersections connecting different rail networks. High-speed rail stations have become multi-storey buildings with different functions; they have become social centers of the city, catering to different needs beyond transportation, with stores, restaurants, hotels and offices where people can spend their time outside of transportation. The Santa Maria Novella (SMN) train station in Florence and the Atocha train station in Madrid are two representative train stations in Europe that play an important role in their respective cities. Using Santa Maria Novella Train Station in Florence, Italy, and Madrid Atocha Train Station in Madrid, Spain, as case studies, this study explores the multifaceted relationship between cities and train stations, how these central train stations have become landmarks and key nodes in their respective cities, and how train stations can be analyzed in terms of their architectural, social, cultural, aesthetic, and landscape dimensions, which can shed light on the future development of transportation hubs and cities provides insights into the future development of transportation hubs and cities, and serves as a reference for urban planning and the construction of transportation facilities.

Keywords train station · Space relations · Urban space · Transportation hub · Transportation facilities

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1 Introduction

In 1830 the world’s first passenger and freight railroad line, the Manchester-Liverpool Railway was opened to traffic, the railroad soon spread across both sides of the Atlantic Ocean, contributing to the formation of the continental and North American railroad network. From the beginning of the twentieth century railroads ushered in the golden age, railroads through the rift valley, embankments, tunnels, bridges, over the Alps, the Western Ghats, the Andes and the Himalayas, through the Isthmus of Panama, the Siberian Manganese and the Sahara Desert, and to promote urbanization, modernization and globalization. As the stopping place of the train, the large-scale construction and successive opening of railroad stations have led to the emergence of large, medium and small city clusters along the railroads, promoting the rapid flow of people, logistics, capital and information flow between cities, and attracting other factors of production to the city to continuously gather, leading to the accelerated development of the modern service industry, thus promoting the transformation and upgrading of industries and the transformation of the city’s development. Accompanied by the rapid development of the railroad industry, and the acceleration of the global urbanization process, the role of railway stations in the urban structure is increasingly significant. They are not only transportation nodes, but also assume the function of gateway to the city, and through a series of spatial, cultural and economic interactions, become the center of urban life Bertolini (1999).

As important transportation hubs in Europe, Florence’s Santa Maria Nuova Train Station (SMN) and Madrid’s Atocha Train Station (Atocha) not only drive local economic and social development, but also have a significant impact on the generation of urban image and cultural identity. Therefore, it is of practical significance to study the role of these two train stations in urban development.

This study aims to explore how train stations form a special relationship with cities through the case studies of SMN train station in Florence and Atocha train station in Madrid. Using literature review, case study and comparative analysis, this thesis systematically explores the interaction between stations and cities from five dimensions, providing lessons for the future integration of cities and transportation hubs (Fig. 1).

Comparison of information on the new Santa Maria train station and the Madrid Atocha train station.

	Stazione Santa Maria Novella Florence(SMN)	Estación de Madrid Atocha(Atocha)
Position	Florence City Center, Italy	Madrid City Center, Spain
Construction time	1934	1851
architectural art	Modernist architecture, clean and simple	Combines nineteenth century industrial style with modern design, incorporating iron frames and glass roofs

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	Stazione Santa Maria Novella Florence(SMN)	Estación de Madrid Atocha(Atocha)
Groups to be addressed	Primarily for tourists and citizens with easy access to Florence's historic shopping centers	An important transportation hub for tourists and citizens alike, while the tropical botanical gardens and historical buildings attract a large number of visitors, making Madrid an important tourist destination
Traffic Hub Function	Main connections to the Italian domestic rail network	Spain's main railroad hub, connecting national and international routes
Division of public space	Functional space design, focusing on the flow of passengers, including some leisure facilities, but the main focus on practicality	In addition to the main functional zoning, it also provides leisure and sightseeing space for the public
environmental sustainability	Functionality-oriented, less environmental design	The introduction of a tropical eco-garden enhances the thermoregulation and humidification of the indoor space and improves the user experience of moderation
protective measure	No special protection policy	Artificial irrigation and no clear protection

2 About Florence SMN train station and Madrid Atocha train station

Florence Santa Maria Railway Station (see Fig. 2, 3) is a major transportation hub and iconic city landmark in Florence, Italy. Designed in the 1930s by Giovanni Michelucci and his team, Florence S.M.N. Railway Station is the fourth largest railway station in Italy and the main railway station in Tuscany. The Florence SMN train station is an important public space that hosts a large number of cultural exchanges. The concentration of museums, theaters and cultural centers around the station has made it a gathering place for citizens and tourists. Its modernist style and functional spaces have become a benchmark for modern urban architecture and have evolved over time into a symbol of the city's culture. The presence of the train station attracted large numbers of tourists to Florence, promoting cultural and economic exchange and prosperity (Mumford, 2000a).

Madrid Atocha Station (see Fig. 4) is one of the main train stations in Madrid, the capital of Spain, and the largest railroad station in Spain. Built in 1851 and completed in 1991 after many alterations and extensions, today it not only meets the needs of the high speed train with modern facilities, but also preserves some of the historical features of the building, especially the famous iron vaulted concourse, which retains its "iron-ism", iron structures and glass domes predominate, reflecting the architectural style of the nineteenth century Industrial Revolution and symbolizing

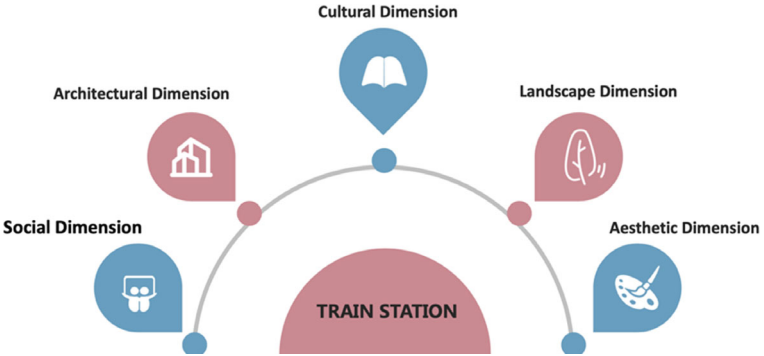


Fig. 1 Five dimensions of analysis



Fig. 2 Signs for Station Santa Maria Novella (S.M.N.), Florence, Italy



Fig. 3 Full view of the exterior of Station Santa Maria Novella (S.M.N.), Florence, Italy

the technological innovations of the time (Garcia, 1995). Inside this hall, a charming tropical garden adds a touch of tranquility to the busy transportation hub. The Atocha Railway Station has had a profound cultural impact on Madrid. More than a train station, it is a historical and cultural symbol of Madrid's urban memory. Not only does it provide a place for residents to socialize and relax, but it has also become a unique cultural icon of Madrid, demonstrating the inclusiveness and diversity of Spanish culture (Serrano, 2012). As an important part of the city's transportation, Atocha Station is connected to the metro, buses and other modes of public transportation for the convenience of tourists and residents (Fig. 5).

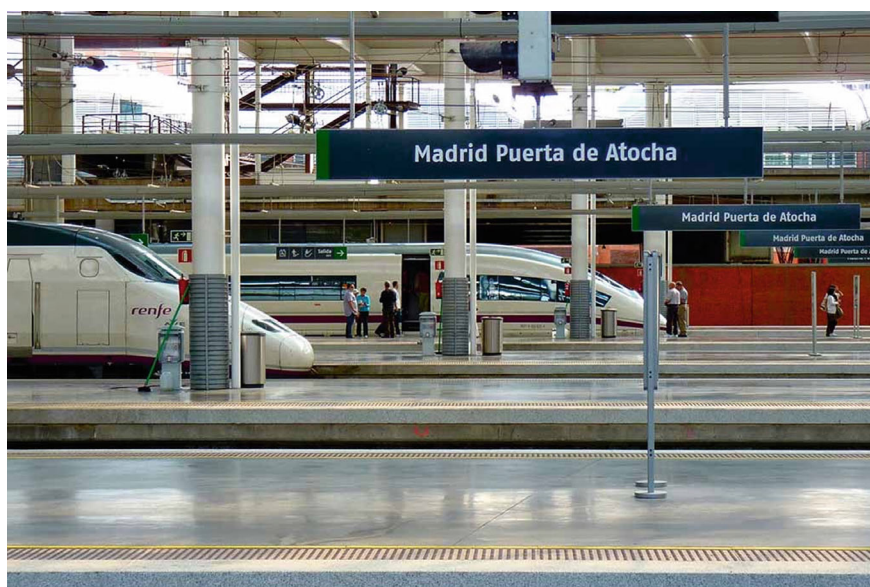


Fig. 4 Signs for Madrid Puerta de Atocha, Madrid, Spain



Fig. 5 Front of Madrid Puerta de Atocha, Madrid, Spain

3 Comparison of five dimensions

3.1 Architecture Dimension

The SMN railway station was built in 1934, at the time when the modernist architectural trend was rising. The architectural style of the station adopts the modernist design principles of minimalism and functionality, abandoning the traditional complex decoration, emphasizing the simplicity and clarity of geometric lines, open space and structure. Modern materials such as reinforced concrete, glass and marble are used in building materials, highlighting the innovation of the modernist style(See Fig. 6). Marble, as one of the traditional Italian building materials, continues the traditional Italian building material culture. The main entrance of the railway station is wide and symmetrical, with a sense of ceremony(See Fig. 7). When passengers enter the station, they feel the grandeur and openness of the space, highlighting the function of the station as a city gateway. The hall is spacious, with a moderate top height and a reasonable space transition. The interior of the hall is also made of marble, wood and other materials, which makes people feel that this is the city gateway when entering the space, and also makes the space more textured. The station uses a lot of glass windows and open spaces to introduce natural light and

create a bright and comfortable waiting environment(See Fig. 8), it also effectively reduces the dependence on artificial lighting. In terms of functional design, the waiting area, ticket gate, luggage storage area and other areas are clearly divided, making it convenient for passengers to quickly find the functional space they need, thereby improving their travel efficiency.



Fig. 6 Domes of modern materials such as reinforced concrete, glass and marble



Fig. 7 Wide and symmetrical entrance gates



Fig. 8 Lots of glass at the top to increase light

Madrid Puerta de Atocha train station is renowned for its architectural significance, blending historic and modern elements. Originally inaugurated in 1851, the station underwent a major reconstruction under the direction of architect Rafael Moneo, completed in 1992 to meet the new demands of high-speed rail travel. Iron and Glass Structure: The original nineteenth century station building is known for its impressive iron and glass roof, a hallmark of historic train station design(See Fig. 9). This style is widely used in many train stations in Europe, such as Gare du Nord in Paris and St. Pancras Station in London (Garcia, 1995). The new design retains the exterior of the historic building while adding a tropical botanical garden and modern waiting area to the interior, demonstrating the fusion of tradition and modernity. The architectural style maintains the original sense of history while incorporating humanistic and ecological design concepts(See Fig. 9) The exterior of the Atocha train station is dominated by red brick, a traditional building material that adds a sense of historical weight to the station and makes it visually harmonious with the surrounding urban architecture. The use of red brick not only enhances the durability of the building, but also gives the station a rustic aesthetic that contrasts with the modern industrial elements of the interior (Mumford, 2000b) (See Fig. 10). The diverse design makes Atocha Railway Station a symbol of Madrid's urban culture and also witnesses the combination of architectural technology and art.



Fig. 9 Humanized and ecological space design



Fig. 10 Historic red brick facade

3.2 *Landscape Dimension*

The modernist style of the Santa Maria Novella Station stands in stark contrast to Florence's Renaissance architecture, but it harmonizes with the surrounding historic buildings rather than overshadowing them. The station's exterior is clad in travertine and has low horizontal lines, a material and design choice that allows it to blend in with Florence's architectural landscape and become part of Florence's cultural landscape, connecting Modernism to the Renaissance (See Fig. 11).

The use of lime in the piazza and indoors also helps to keep temperatures cooler during the warmer months in Florence, which is a practical design choice for the Mediterranean climate (Benelli, 2002). Florence and Modernism: The Santa Maria Novella Station. Florence: University Press. Although the SMN itself has limited green space, it benefits from multiple public gardens and green spaces within walking distance. This proximity to natural space complements the station's function and provides visitors with access to Florence's urban green spaces (See Fig. 12).

Inside the Madrid Puerta de Atocha train station, there is a large indoor tropical garden with more than 7,000 introduced plants representing more than 260 species, creating a biodiverse ecosystem. These species, mainly from the tropics, require high humidity and are maintained by an artificial misting system (See Fig. 13). While maintaining the gardens does require resources for watering and maintenance (Salazar, 2007), the gardens help to regulate the temperature and humidity within the station, reducing the reliance on artificial climate control systems. This contributes to a more sustainable indoor environment and increases passenger comfort (Alvarez, 2015). Gardens play a small but meaningful role in supporting urban biodiversity.



Fig. 11 Lime façade with history



Fig. 12 People sitting and resting on the green and along the paths in front of the new Virgin Mary train station plaza

The small pond within the garden adds to the visual and sensory appeal of the landscape(See Fig. 14), providing visitors with a soothing natural element that complements the greenery, and the water represents life and renewal in the landscaping, emphasizing the station's role as a transit point for travelers coming and going.

It also symbolizes Madrid's commitment to integrating sustainable and ecological design into the city's infrastructure. The classic and glass architecture of the old part is complemented by the sleek and modern design of the new extension(See Fig. 15). The area around the train station features plazas and streets to encourage pedestrian travel and easy access to the city's attractions.

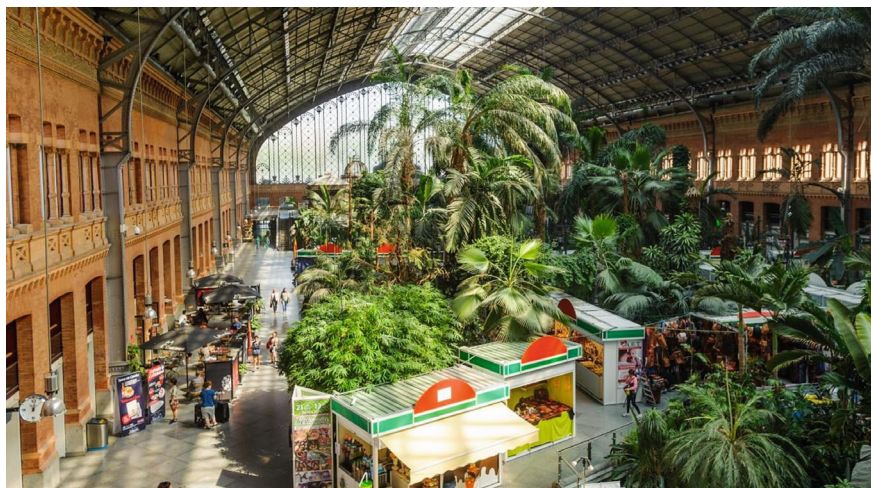


Fig. 13 Oversized man-made tropical gardens

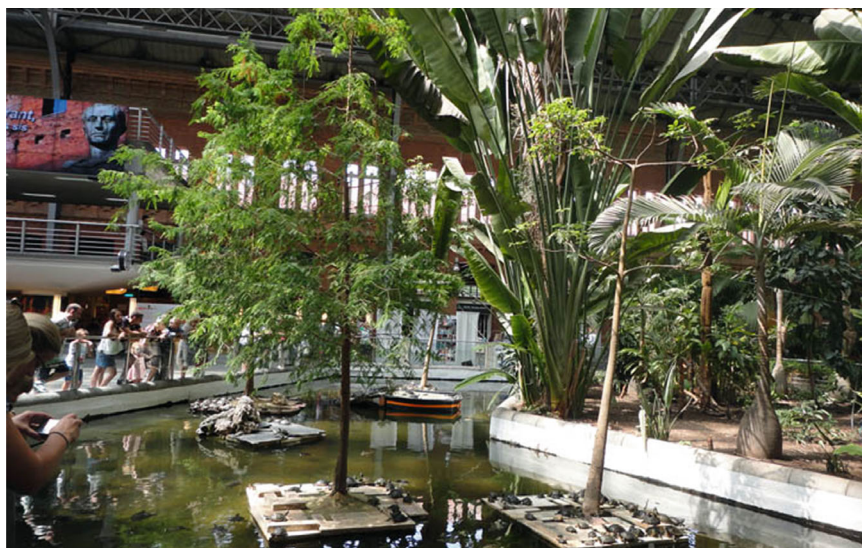


Fig. 14 Small pond at Madrid Puerta de Atocha train station



Fig. 15. new part at Madrid Puerta de Atocha train station

3.3 *Cultural Dimension*

With regard to heritage, the introduction of the concept of cultural assets in the Hague Charter (1954) was crucial. Since then, the industrial heritage, defined in the Charter of Lower Tagil (2003), is based on the TICCIH definition (Carta de Nizhny Tagil, 2003), i.e. industrial cultural monuments of historical, technical, functional or social value, not excluding architectural value, which explicitly includes railway stations, which is considered appropriate.

In facing history, Atocha station respects its historical roots by preserving the original building structure and integrating gardens, while adapting to modern needs, which creates a landmark that respects its industrial past and embraces a green future. Santa Maria Novella, on the other hand, connects and extends its Renaissance past through modernism but using traditional marble materials. Both stations have chosen to respect history.

In addition, the 2004 Madrid train bombings took place at the Atocha station, killing 191 people and becoming an integral part of the Spanish collective memory. In memory of the victims, a monument was built in the station (see Fig. 15), making it a place of remembrance and reflection for locals and tourists. The monument adds cultural depth to the station, and the Atocha station becomes a symbol of resilience and solidarity.

Santa Maria Novella is also often used for educational purposes. Architectural scholars and students study the design and architectural style of the station to understand the evolution and application of modernism in Italy.

3.4 Social Dimension

The new Santa Maria railway station not only provides domestic full and slow trains and high speed trains to meet the travel needs of different groups of people, but also provides train routes with other European countries. This diversity of connections not only facilitates the travel of local residents, but also provides convenient transportation services for international tourists and business travelers, promoting economic and cultural exchanges between Florence and other regions.

As the main train station in Florence, the SMN station is the first stop for many tourists entering the city and Tuscany. Inside the station, there are information service centers, map distribution points and tourist guides as well as advertisements for local Tuscan products, making it easy for tourists to get relevant information and guidance while creating local specialties ip.

The new Santa Maria Novella Train Station is also an important place for public space and civic activities in the city. The waiting hall inside the station and the open squares around the station provide space for citizens to gather, rest and communicate. Libraries, shopping streets, cafes, restaurants, commercial ecosystems, and everything in between. It is not only part of citizens' daily lives, but also provides space for various cultural activities and bazaars, enhancing the station's social functions. The open space in and around the station often hosts temporary exhibitions, festivals, celebrations and other cultural events, providing a rich cultural experience for citizens and visitors. The station is also equipped with first aid and security facilities, making it a reassuring public space, as well as emergency shelters, etc. The presence of the SMN station is not only a symbol of Florence's modernity, but also a socio-cultural vehicle for the new era of this historic city, adding an indispensable value to the social life of Florence.

3.5 Aesthetic Dimension

Railway stations should not be interpreted as "picturesque places" but as "everyday places" (Ilies et al., 2017). Nevertheless, the Spanish National Geographic magazine has selected some of the most beautiful railway stations in the world. There are railway stations for all tastes and almost all eras. One of them is Madrid Atocha Railway Station, which is enough to illustrate the beauty of Atocha Railway Station. The arch of Atocha Railway Station has a strong sense of art in aesthetics. The wide span and high arch design not only meet the needs of passenger flow, but also have excellent ventilation and lighting functions. The botanical garden and waterscape under the arch form a dynamic landscape visually. With the change of natural light and weather, it reflects different light and presents different aesthetics, providing passengers with multi-dimensional visual enjoyment.

The aesthetic design of Florence's new Santa Maria Novella train station conveys the spirit of Florence's constant pursuit of innovation and breakthrough. As a modern

building, it is unique in the historic city of Florence, demonstrating not only the diversity of architectural aesthetics, but also Florence's cultural self-confidence in the new era (Capoccia, 2010). SMN Train Station pursues the combination of utility and aesthetics, and the design philosophy of putting function above all else has kept the station's interior free from excessive ornamentation, but the clean lines make the station unobtrusive and elegant, and symmetrical design is the hallmark of SMN Train Station, with the height, width, and proportionality of each area being carefully designed to make it appear visually balanced. The height and width of the concourse, as well as the proportionality of each area, have been carefully designed to make the building visually balanced and have a sense of order. The use of traditional marble materials is dignified in texture and warm in vision, so that one can feel the key word Renaissance when arriving at the station.

4 Discussion and Conclusion

Train stations as shapers and regulators of territories and urban fabrics, catalysts of changes in urban dynamics and socio-economic conditions, historic stations are landmarks that shape the urban fabric, and their large footprints and track layouts represent dynamic industrial landscapes in the process of urban development and growth, the integration of which is essential for the preservation of significance (Martinez-Corral et al., 2022).

The lack of protection in railway stations is serious. Florence's Nova Santa Maria train station and Madrid's Atocha train station represent a representative sample of train stations with some degree of legal protection. However, the analysis shows a certain complexity due to the fact that train stations act as gateways to cities, have different levels of foot traffic and have different functions. With regard to architectural protection, 100% of the cases analyzed fall into the category of monuments, without taking into account the industrial landscapes associated with the stations they represent, and in a few cases the stations have been declared assets of cultural value, and no action has been taken in their protected environments, which is why it is important to reconsider the policies and possible actions for the protection of train stations. We must also emphasize that we can save most abandoned railway stations through reuse/re-use (Podwojewska, 2017).

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